2000 Piping Plover Breeding Activities
Cape Hatteras National Seashore

Cape Hatteras National Seashore (CAHA) continued to oversee Piping Plover (Charadrius melodus) breeding management during the year 2000. The project could not have been completed without the daily assistance of volunteers Jason Lycans, Andrew Glass and Amanda Prossick. Their work, in part, was supported by a contribution from the North Carolina Beach Buggy Association.

Efforts in 2000 included: 1) locating breeding plovers and nests, 2) protecting territories and nests, 3) monitoring nests and broods.

Location of Breeding Plovers and Nest
Beginning in early April, beaches were surveyed for plover activity. These surveys included sites that had been previously used for nesting as well as those deemed suitable but had no nesting documented in recent years. When plovers exhibited territorial or courtship behavior, the sites were investigated for the presence of nests. If none were found, the territories were revisited every two to seven days in attempts to locate newly initiated nests.

Territory and Nest Protection
Potential and known breeding sites were closed to the public during the last week of March and first week of April. Each area was surrounded by symbolic fencing and twine. All located nests were protected by predator exclosures. These have been used in the Seashore for seven consecutive seasons.

Nest and Brood Monitoring
Nests were viewed from a distance every one or two days during incubation. Observers noted the behavior of adults, presence of predators and the condition of the predator exclosure. Nests were approached briefly once a week to closely inspect the exclosure and search for any predator tracks. After hatching, each brood was monitored at one or two day intervals. Observers noted brood status, behavior, movements, human disturbance, predator contacts or any other environmental interactions.

Results and Discussion

Productivity
Four pairs of Piping Plovers were found at CAHA during the 2000-breeding season (Table 1, Chart 1). This is the lowest breeding population recorded since monitoring began in 1989. In recent years, the trend has been a reduction in breeding pairs. Between 1989 when comprehensive monitoring began and 1997, eleven to fifteen pairs were identified annually. In 1998, only nine pairs were found. This declined to six pairs in 1999. The number of sites utilized by breeding birds is also in decline. In 1996, six areas of CAHA supported nesting. This season, breeding was found only at two sites, Cape Point and Hatteras Inlet spit and fewer pairs were present than previous years' averages. The South beach and South Ocracoke spit sites were not used for the first time in several years. A male established a territory at South beach throughout most of the season but no female was ever observed at the site. Oregon Inlet and North Ocracoke sites have not been utilized for

nesting in several consecutive years. No pairs nested on neighboring Pea Island Wildlife Refuge. Cape Lookout National Seashore reported a significant decline in breeding pairs in the past two years. Suitable habitat still appears to be present at these traditionally used sites.

The four CAHA pairs produced six known nests this season (Table 2). Three nests (50%) successfully hatched. Three nests (50%) were unsuccessful. The average clutch size was 3.8 eggs per nest. Of the 23 known eggs, 10 (43%) hatched (Table 3, 3a). Three chicks (30%) survived to fledgling age. Fledgling rate was 0.75 chicks per breeding pair (Table 4) representing a decline from the past two years' record highs of 1.2 and 1.3 fledglings per pair. Productivity rates between 1989 and 2000 have ranged from 0.2 to 1.3 (Table 4a). Most years have been far below the recovery goal set by US Fish and Wildlife Service of 1.5 fledglings per breeding pair. The reduced breeding population we are now seeing is likely a reflection of low productivity over the years. It is felt a population would need to produce 1.2 fledglings per breeding pair annually to sustain a population and higher to increase a population.

Two of the three successful nests produced fledglings in 2000. Of these, one nest represented an initial nesting attempt by a pair of adults. The other successful nest was a pair's second nesting attempt.

Nest Loss/Abandonment

Of the three failed nests, a single weather event contributed to the loss of two. A three-day storm at the end of May produced high winds, heavy rain and ocean overwash. One clutch at Cape Point was buried under wind blown sand and abandoned while the second was lost to flooding at Hatteras Inlet spit. The third nest, located at Hatteras Inlet was likely lost to ghost crab predation. A crab burrow was observed next to the nest at the time the eggs were found missing. The burrow was not excavated to find possible eggshell remains. All three nests were protected by predator exclosures.

Chick Mortality

Chick loss was high at 70%. This follows two consecutive years of comparatively low chick mortality. The mortality rate in 1999 was 36% and 40% in 1998, In previous breeding seasons between 1989 and 1997, chick losses ran between 46% and 90% (Wrenn 1990, Collazo 1992-1994, Lyons 1995-1997).

In past breeding seasons, the majority of chicks were lost within ten days of hatching. This also proved true in 2000. Of the seven chicks lost, six were lost between one and five days of age. A single bird was lost at 12 days old (Table 5, Chart 2). No definite cause of chick mortality was determined this year however frequent periods of heavy rain may have been a contributing factor.

Predator Exclosures

All six nests (100%) were exclosed. Three were successful and an equal number of nests failed. Predator exclosures did not appear to contribute to nest loss. Two were impacted by storms and a third was likely lost to a ghost crab that reached the clutch by passing through the exclosure fencing. Besides the crab incident, no other evidence of predators was associated with the exclosures.

Predator exclosures have been used at CAHA for the past seven years. Their use has resulted in higher hatching rates. Between 1995 and 1998 hatch rates have ranged from 75% to 90%.

However, in each of the past two years rates were comparatively lower, where only half of the exclosed nests (50%) successfully hatched.

It was hoped that the use of predator exclosures would help boost overall fledgling rates but with few exceptions the rates have been low (Table 4a). Record highs were found 1998 and 1999, with 1.3 and 1.2 respectively. Food availability studies conducted by CAHA in 1998 showed a five-fold increase in prey compared to a similar study in 1996 (Kuklinski and Fraser, 1996). The use of exclosures in combination with high food availability may have been responsible for increased productivity in 1998. If food availability is a highly variable limiting factor, chick survival may also be highly variable.

Predation

A ghost crab may have been responsible for the loss of a clutch at Hatteras Inlet spit. An active crab burrow was found within the exclosure when the nest was checked and all eggs were found missing. A similar situation was discovered last year at the same site. In a separate situation this season, an unhatched and abandoned egg disappeared after a ghost crab hole appeared next to the egg. If suspect, crab burrows need to be examined promptly for eggshell fragments. The presence of potential predators was documented at all sites. Fish crows (Corvus ossifragus) and various species of gulls were present at each breeding site but few aggressive interactions were observed. Tracks from gulls, crows, raccoons (Procyon lotor), Virginia opossum (Didelphidae virginiana), dogs (Canidae), and feral cats were recorded within plover breeding territories. In attempts to control the feral cat population live traps were placed near bird nesting sites but trapping success was low. Two feral cats were live-trapped near tern colonies in the Seashore this summer.

Human Disturbance

Evidence of human entry was found at all plover breeding sites. Pedestrian and vehicle entries in bird nesting areas were recorded. These areas were not exclusively used by Piping Plover but also by American Oystercatcher, Black Skimmer and various species of terns. Disturbance observations are conservative since they were not made continuously throughout the Seashore and some incidents involved more than one pedestrian or vehicle. Most were not witnessed but documented based on tracks left behind. Between May and August 2000, 58 incidents were recorded of off-road vehicles entering designated bird closures. These incidents required, at minimum, repairs to twine strung between posts but often involved the replacement of broken posts and signs. Fifty-six incidents of pedestrians entering posted bird closures were noted Parkwide.

Conclusion

The reduced number of breeding pairs within CAHA is significant. All previously known nesting areas have experienced declines in number of pairs. No nesting occurred on four of six previously used breeding sites.

Fledgling rates still remain below what the US Fish and Wildlife Service seeks for piping plover recovery (1.5 fledglings per breeding pair). CAHA will soon begin a more aggressive program to reduce feral cat populations. Other problem animals that have learned to target nesting birds should be addressed. Human disturbances still exist. Though bird closures are clearly marked, pedestrians or vehicle operators do not always respect the posted areas. The leash law is not consistently enforced in all areas of the Seashore. Visitors need to be made more aware of their impacts. A

greater law enforcement presence, along with written citations would also be of help as recreational uses continue to increases each year. Surveys in the non-breeding season should continue.

An Atlantic Coast Piping Plover Workshop was held in January 2001. Group discussions were held among those representing states in the southern portion of the plover's breeding range (Maryland, Virginia and North Carolina). Management issues discussed by this group were predator management and breeding habitat enhancement. One research need identified was intensive monitoring of broods during the first few critical days after hatching. This is when the majority of chicks are lost to unknown causes. Another research proposal involved comparing egg and chick weights in the southern breeding range to those further north where fledgling rates are higher. The results may reflect on the vigor of the adults at time of breeding.

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Literature Cited

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Table 1.	Number of piping plover breeding pairs by site in Cape Hatteras National Seashore from 1985 to 2000.						
	Total Pairs	**Sites within Cape Hatteras National Seashore**					
	in Seashore	Oregon Inlet	Cape Point	South Beach	Hatteras Inlet	North Ocracoke	South Ocracoke
1985	9						
1987	10	0	4	0	4	1	1
1989	15						
1990	14	0	8	0	4	2	0
1991	13	0	5	0	3	5	0
1992	12	0	4	0	4	4	0
1993	12	0	5	1	3	3	0
1994	11	0	5	1	3	2	0
1995	14	0	6	1	4	2	1
1996	14	1	5	1	5	1	1
1997	11	1	4	1	3	0	2
1998	9	0	4	1	3	0	1
1999	6	0	3	1	1	0	1
2000	4	0	2	0	2	0	0
average	11.8						

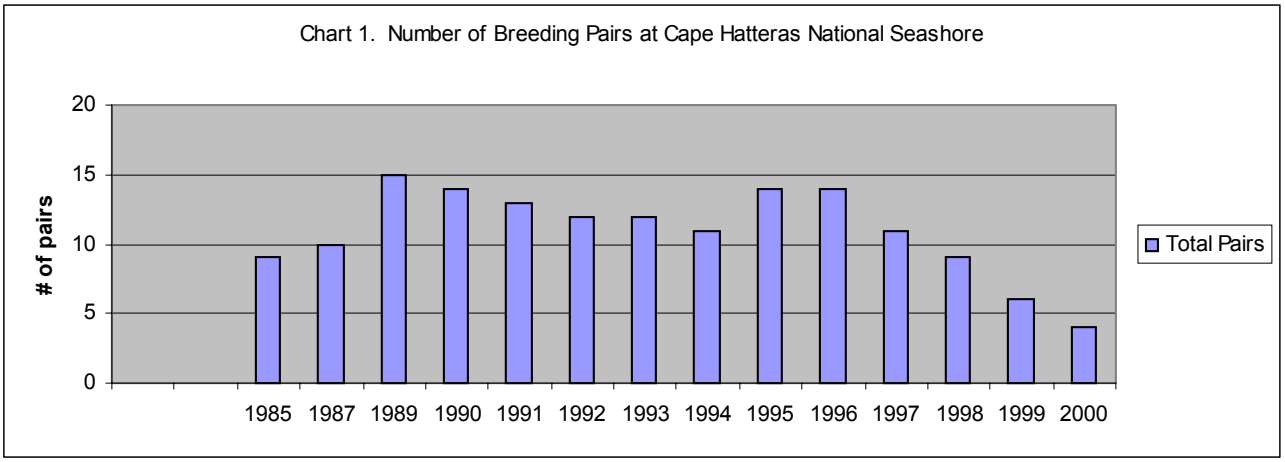

Table 2. 2000 piping plover nesting season at Cape Hatteras National Seashore

LOCATION	#BREEDING PAIRS	#NESTS	#NESTS HATCHED	#NESTS LOST	#CHICKS FLEDGED	#CHICKS LOST
OREGON INLET	0	0	0	0	0	0
CAPE POINT	2	3	2	1	2	4
SOUTH BEACH	0	0	0	0	0	0
HATTERAS INLET	2	3	1	2	1	3
OCRACOKE NORTH	0	0	0	0	0	0
OCRACOKE SOUTH	0	0	0	0	0	0
TOTAL	4	6	3	3	3	7

Table 3. Piping plover hatching success on Cape Hatteras National Seashore for 2000.

LOCATION	# NESTS	# EGGS	NESTS LOST / ABANDONED		NESTS HATCHED		EGGS HATCHED		NESTS W/ FLEDGED CHICKS	
		(a)	#	%	#	%	#	% (a)	#	%
OREGON INLET	0	0	0	0%	0	0%	0	0%	0	0%
CAPE POINT	3	11	1	33%	2	67%	6	55%	1	33%
SOUTH BEACH	0	0	0	0%	0	0%	0	0%	0	0%
HATTERAS INLET	3	12	2	67%	1	33%	4	33%	1	33%
NORTH OCRACOKE	0	0	0	0%	0	0%	0	0%	0	0%
SOUTH OCRACOKE	0	0	0	0%	0	0%	0	0%	0	0%

(a) -includes all eggs found

Table 3a. Piping plover hatching success on Cape Hatteras National Seashore for the past nine years.

YEAR	# NESTS	# EGGS	NESTS LOST / ABANDONED		NESTS HATCHED		EGGS HATCHED		NESTS W/ FLEDGED CHICKS	
			#	%	#	%	#	%(a)	#	%
2000	6	23	3	50%	3	50%	10	44%	2	33%
1999	6	23	3	50%	3	50%	11	48%	3	50%
1998	8	31	2	25%	6	75%	20	65%	5	63%
1997	16	47(b)	6	38%	10	63%	32	68%	2	13%
1996	16	56(b)	6	38%	10	63%	30	53%	2	13%
1995	19	63	6	32%	13	68%	30	48%	6	32%
1994	18	65(c)	8	44%	10	56%	32(d)	49%	6	33%
1993	21	69	12	57%	9	43%	27	39%	5	24%
1992	14	49(e)	6	43%	8	57%	17	35%	6	43%

(a) - of all known eggs

(b) - assumes 1 egg from a brood whose nest was not found

(c) - assumes 2 eggs from a brood whose nest was not found (see 1992 report)

(d) - includes those presumed hatched (see 1994 report)

(e) - assumes 3 eggs from a brood whose nest was not found (see 1992 report)

Table 4. Fledging success of piping plovers on Cape Hatteras National Seashore for 2000.

LOCATION	# PAIRS	# BROODS	# CHICKS	AVE. BROOD SIZE (chicks/ brood)	CHICKS FLEDGED		BROODS WITH FLEDGED CHICKS		FLEDGE RATE (chicks/pair)
					#	%	#	%	
OREGON INLET	0	0	0	0.0	0	0%	0	0%	0.00
CAPE POINT	2	2	6	3.0	2	33%	1	50%	1.00
SOUTH BEACH	0	0	0	0.0	0	0%	0	0%	0.00
HATTERAS INLET	2	1	4	4.0	1	25%	1	100%	0.50
NORTH OCRACOKE	0	0	0	0.0	0	0%	0	0%	0.00
SOUTH OCRACOKE	0	0	0	0.0	0	0%	0	0%	0.00
Total	4	3	10	3.3	3	30%	2	67%	0.75

Table 4a. Fledging success of piping plovers on Cape Hatteras National Seashore for the past nine years.

YEAR	# PAIRS	# BROODS	# CHICKS	AVE. BROOD SIZE (chicks/brood)	CHICKS FLEDGED #	CHICKS FLEDGED %	BROODS WITH FLEDGED CHICKS #	BROODS WITH FLEDGED CHICKS %	FLEDGE RATE (chicks/pair)
2000	4	3	10	3.3	3	30%	2	67%	0.75
1999	6	3	11	3.7	7	64%	3	100%	1.20
1998	9	6	20	3.3	12	60%	5	83%	1.33
1997	11	10	32	3.3	3	9%	2	20%	0.27
1996	14	10	30	3.0	3	10%	2	20%	0.21
1995	14	13	30	2.3	7	23%	6	46%	0.50
1994	11	10(a)	32(b)	3.2	9	30%	6	60%	0.82
1993	12	9	27	3.0	8	30%	5	56%	0.67
1992	12	8	17	2.1	8	47%	6	75%	0.67

(a) - includes 2 broods whose nest was presumed hatched (see 1994 report).

(b) - includes 8 chicks from 2 nests that was presumed hatched (see 1994 report).

Table 5. Age distribution of chick mortalilty on Cape Hatteras National Seashore (1990-2000)																									
Age (days)																									
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1999	2			1																					4
1998	2	1				2	1		1													1			8
1997	2	3	5	5	1	1	4				1	1	1	2	1			2							29
1996	4	8	2	4	1			3			2	1												1	27
1995		7	2	2	3	1	2	1		1	1	1													23
1994	2		6					1	1	2					1	1		1							15
1992		2	1	2	2	2			1				1					1							12
1991			1	2	1	1	3	5	2	1							3								19
1990	3	1	2	4	1	1	2	1			2	2		1											23
2000	1		2	1							1														7
1990-2000	16	22	21	21	9	8	12	11	5	4	7	5	2	3	2	1	3	4	0	0	0	1	0	1	167